

Geology (GLG)

GLG 111. The Dynamic Earth. (3)

Earth as a geophysical-geochemical unit and its internal and external processes. Formation of minerals and their relationships in rocks. Earth stresses and rock deformation, mountain building, and earthquakes. Geomorphic (landscape) evolution by mass wasting and wave, stream, wind, ground water, glacial, and volcanic activity. IVB. PA-2B. CAS-D. CAS-QL.

GLG 115L. Understanding the Earth. (1)

Laboratory course exploring Earth from multiple perspectives. Earth in the solar system; Earth in time; the solid Earth; Earth's surface in flux; Earth's atmosphere and hydrosphere. IVB. PA-2B. CAS-D/LAB. Prerequisite or Co-requisite: any 100-level, 3 credit hour GLG course (students enrolled in these courses are not required to take the lab).

GLG 121. Environmental Geology. (3)

A survey of introductory geology with a sub theme of human interaction with the geologic environment. Topics include flooding, earthquakes, volcanoes, water quality and availability, energy, use and abuse of natural resources and land-use planning. IVB. PA-2B. CAS-D. CAS-QL.

GLG 141. Geology Of U.S. National Parks. (3)

The National Parks protect historical, natural, and geologic structures. Investigations in public conservation methods are explored to understand geologic features, systems, and heritage. This course looks closely at basic geologic concepts with a sub theme of the geologic evolution of North America as exemplified by the geologic features and development of U.S. national parks and other public lands. IVB. PA-2B. CAS-D. CAS-QL.

GLG 147. Introductory Seminar - Geology & Environmental Earth Science. (1)

Introduction to Geology & Environmental Earth Science, focusing on department orientation, research opportunities, professional development and career guidance. Conducted in seminar/lecture format.

GLG 177. Independent Studies. (0-6)

GLG 204. Survival on an Evolving Planet. (4)

Paleontology is the scientific study of past life, and is therefore an interface between geology and biology. It includes such topics as the origin of life, mass extinctions, exceptional fossil preservation, and response of past ecosystems to climate change, to name a few. This course provides an overview of the history of life and an introduction to the primary research areas in paleontology. Prerequisite: any 100-Level BIO or GLG course.

GLG 211. Chemistry of Earth Systems. (4)

Material presented serves as the basis for dynamic links with upper-division courses within the department. The chemical evolution of the Earth is presented spanning all pressure and temperature conditions. Major geological processes are discussed with respect to the chemical principles controlling the distribution of elements and mass, e.g., earth formation and differentiation, mantle evolution, crustal genesis, formation of the atmosphere and oceans, chemical weathering, and cycling of elements in surficial environments. Analytical and computational aspects of solid earth and environmental geochemistry are introduced. CAS-D.

Prerequisites: GLG 111 or 121 or 141; and GLG 115L.

GLG 244. Oceanography. (3)

Examination of the major features of the ocean and the processes active there. Oceanic currents, waves and tides, biologic productivity and zonation, nutrient cycles, chemical parameters, bathymetry, and sediments explored.

Prerequisite: one natural science course from MP, or CAS-D.

GLG 261. Geohazards and the Solid Earth. (3)

Examines solid earth physical principles including theory and application. Applications will focus on the nature of geologic hazards and the Earth's interior, which will then be related to overriding scientific theories like plate tectonics and the observations they are based on.

Prerequisite: any 100-level 3 credit hour GLG course, or GEO 121, or PHY 111, or PHY 161, or PHY 191.

GLG 277. Independent Studies. (0-6)

GLG 301. Sedimentology and Stratigraphy. (4)

Description and evaluation of sedimentary processes, sedimentary environments of deposition and the rocks that form in these environments are integrated with field trips and laboratory analyses of rocks in hand sample and thin section. Stratigraphic principles, sequence stratigraphy, and basin analysis are linked to global climate change and tectonics throughout geologic time. ADVW. PA-1C.

Prerequisite: any 100-level, 3 credit hour GLG course and GLG 115L or permission of instructor.

GLG 307. Water and Society. (3)

Provides a basic scientific understanding of what water is, where it resides and how it moves throughout the entire hydrologic cycle both on a global and watershed scale. Topics emphasize the importance and fragility of water resources and the world-wide threats to those resources. Major issues examined include flooding, water scarcity, irrigation, settlement of arid land, international water conflict and contamination of drinking water supplies. Topics are examined not only through a natural science perspective, but also through perspectives of history, policy, law and societal attitudes. PA-2B, SI-01. Prerequisite: any 100-level, 3 credit hour GLG course, or GEO 121.

GLG 311. Geoenvironmental Field Methods. (3)

Develops environmental geoscience field skills useful for fundamental and applied investigations. Students learn to test field hypotheses and construct professional reports and will develop a portfolio of project work.

Prerequisites: GLG 111 or 121 or 141 and 115L.

GLG 322. Structural Geology. (4)

Origins and characteristics of primary and secondary structures of Earth's crust. CAS-D/LAB.

3 Lec. 1 Lab.

Prerequisite: any 100-level, 3 credit hour GLG course; GLG 356 and GLG 301 (recommended prerequisites: MTH 151, 153, or 157).

GLG 335. Ice Age Earth. (3)

Introduces the study of climate change as recorded in the geologic record. Discusses natural and anthropogenic causes for climate change.

Prerequisite: GLG 111, 121, 141 or GEO 121.

GLG 340. Internship. (0-20)**GLG 342. Geoarchaeology. (3)**

An introduction to geoarchaeology as a multidisciplinary field incorporating human-environment interactions, earth resources, and sustainability. The course focuses on natural processes that shape the archaeological record, and stratigraphic, geochemical, isotopic, and geophysical approaches to reconstructing landscapes of the past as a context for archaeological deposits. Lectures and discussions address site, intra-site and landscape scales in light of how processes of erosion, deposition, weathering, and biological and human activity shape the archaeological record. CAS-D.

Prerequisite: GLG 111 or GLG 121 or GLG 141 or ATH 212, or permission of instructor.

GLG 354. Geomorphology. (4)

Evolution of landscapes and landforms on Earth and other planets and the processes responsible for their formation. Analysis of landforms to assess the relative role of climate, tectonics, and humans in their formation.

Prerequisites: GLG 111, GLG 121 or GEO 121.

GLG 356. Mineralogy. (4)

Composition, physical properties, symmetry, crystal structure, and geologic occurrence of rock-forming minerals. CAS-D.
3 Lec. 1 Lab.

Prerequisites: GLG 111 or 121 or 141; and GLG 115L.

Prerequisites or Co-requisites: GLG 211; or CHM 141 and CHM 144.

GLG 356L. Mineralogy Lab. (0)

Composition, physical properties, symmetry, crystal structure, and geologic occurrence of rock-forming minerals. CAS-D.

Prerequisites: GLG 111 or 121 or 141; and GLG 115L.

Prerequisites or Co-requisites: GLG 211; or CHM 141 and CHM 144.

GLG 357. Igneous/Metamorphic Petrology. (4)

Theoretical, quantitative, and petrographic investigation of igneous and metamorphic rock physical and chemical characteristics and formational processes.

Prerequisite: any 100-level, 3 credit hour GLG course and GLG 356 (GLG 211 is recommended).

GLG 377. Independent Studies. (0-6)**GLG 402/GLG 502. Geomicrobiology. (3)**

Focuses on mutual interactions between microbial and geological processes. Topics include: role of microorganisms on mineral weathering rates, microbial mediated ore deposit formation, microbe enhanced oil recovery, life in extreme environments, search for bio-signatures in geological records and meteorites and implications for life on Mars, microbial ecology in ocean floor hydrothermal vents.

Prerequisite: GLG 244 or permission of instructor.

GLG 408/GLG 508. Introduction to Hydrogeology. (4)

Introduction to the physical properties governing groundwater-flow in various geologic media and settings. Methods are explored for determining groundwater-flow directions and velocities and aquifer characteristics and potential. Introduction to groundwater-flow modeling and principles of mass transport and groundwater contamination.

3 Lec. 1 Lab.

Prerequisite: any 100-level, 3 credit hour GLG course, or permission of instructor.

GLG 411A/GLG 511A. Field Geology. (6)

Taught annually during June through July at Miami University Geology Field Station, Dubois, Wyoming. Students identify, classify, and interpret geologic features and synthesize and communicate geologic interpretations. Students work outdoors six to eight hours a day and individually create geologic maps using pace and compass, topographic map base, air photo, and satellite image bases with the assistance of GPS satellite navigation receivers and software. Geologic mapping and rock interpretation techniques are the subject of evening lectures. Summer only. SC.

Prerequisite: GLG 201, 301, 322, and 357 or equivalents or permission of instructor.

GLG 412. Tropical Ecosystems of Costa Rica. (5)

Introduces students to the structure and function of neotropical ecosystems, as well as to geological, biological, cultural, and economic forces affecting biodiversity in the tropics. This course is taught on-site in Costa Rica. There are additional costs beyond tuition.

Cross-listed with GEO/IES 412/IES 512.

GLG 417/GLG 517. Forensic Isotope Geochemistry. (3)

Application of stable and radiogenic isotope systems to contemporary forensic problems including environmental contamination, climate change and wildlife forensics, archaeological forensics, animal migration patterns, soil provenancing, human provenancing, food authenticity and traceability, and criminal investigations including drug use and trafficking, weapons tracing, and counterfeit detection. Analytical methods, data quality, and isotopic mapping and modeling will be discussed as a basis for quantitative and qualitative forensic diagnostics.

Prerequisites: GLG 356, GLG 211 or GLG/CHM 275; or permission of instructor.

GLG 419/GLG 519. Geology of Streams. (3)

This field course examines the nature of streams, how humans have impacted stream systems in the US, and efforts underway to restore streams to their natural conditions. Students will canoe down waterways and camp along the river at night. Students will learn to collect and evaluate primary field data for the purpose of stream classification, quality habitat assessments, and evaluating human impacts and modifications to streams. This data may entail aspects of fluvial geomorphology, surficial geology, and water chemistry analysis. Students will analyze data in the field, and complete a final research project after completion of the field component of the course. This course is only offered as part of a credit workshop. EL.

Prerequisites: GLG 111, GLG 121, GLG 141, or approval of Instructor.

GLG 427/GLG 527. Isotope Geochemistry. (3)

Natural variations, measurement techniques, and geologic applications of radiogenic and stable isotopes.

Prerequisites: GLG 211 and GLG 357.

GLG 428/GLG 528. Hydrogeological Modeling: Groundwater Flow and Contaminant Transport and Fate. (4)

Explores techniques used in constructing and solving mathematical models of groundwater flow and contaminant transport. It reviews and covers the basic theory associated with these processes including the physical processes that govern the flow of groundwater in various geologic media and settings and the chemical, biological and physical processes involved in contaminant transport and fate in groundwater systems. The course explores how to incorporate our understanding of these various processes into numerical models that help us explore and come to a better understanding of natural systems and make predictions. The course also develops familiarity some widely-used packaged models while learning about grid and boundary design, model parameter-value selection, calibration and exploration of uncertainty.

GLG 432/GLG 532. X-ray Powder Diffraction and Clay Analysis. (3)

Covers one of the most utilized analytical methods in geology and materials characterization, powder X-ray diffraction. It is a hands-on active learning course involving theory and application of diffraction to phase identification, structural analysis and quantitative analysis of clays, soils, sediments, etc. It also covers the mineralogy and crystal chemistry of the clay minerals.

Prerequisites: GLG 356 and CHM 141 or permission of instructor.

GLG 435/GLG 535. Soils and Paleosols. (3)

Introduces methods of soil morphology, taxonomy, and genesis of modern and fossil soils. Describes how to use fossil soils to infer past environmental conditions.

Prerequisite: GLG 301 or permission of instructor.

GLG 436/GLG 536. Paleoclimatology. (3)

Reviews stable isotopic techniques to reconstruct climate change over geologic time scales from various types of records, including ocean sediment cores, ice cores, lakes, soils, and speleothems. Recommended prerequisite: GLG 335.

GLG 437/GLG 537. Paleontology in Conservation. (3)

This course explores the needs of conservation scientists, what paleontological data contribute, and new methods for synthesizing modern and paleontological data to develop effective strategies for conservation, remediation, restoration, and policy.

Prerequisite: BIO 206, or BIO 209, GLG 204, or permission of the instructor.

Cross-listed with BIO 437.

GLG 450/GLG 550. Sedimentary Basin Analysis. (3)

Evaluation of the physical mechanisms of sedimentary basin formation including isostasy; flexure, thinning and thermal contraction of the lithosphere; subsidence analysis; sequence stratigraphy; paleocurrents and sediment provenance; and tectonics of sedimentary basins.

Prerequisite: GLG 301.

GLG 461/GLG 561. Geophysics. (3)

Active learning course on solid earth geophysics, covering theory and application. Techniques include seismology, GPS, gravity, magnetics, and mineral physics. Application will focus on large-scale tectonics and the Earth's interior, but will also include some exploration geophysics.

Prerequisite: MTH 151, 153 or MTH 157; PHY 161 or PHY 191.

GLG 467/GLG 567. Seismology. (3)

Active learning course on seismology covering theory and application. Topics will include elastic wave propagation, reflection/refraction seismology, waveform modeling, tomography plate kinematics, and time series analysis. Applications will focus on earthquakes and large-scale tectonics.

Prerequisites: MTH 151 or MTH 153; PHY 161 or PHY 162 or PHY 191 PHY 192; or consent of instructor.

Cross-listed with PHY.

GLG 477. Independent Studies. (0-6)**GLG 492/GLG 592. Global Tectonics. (4)**

Fundamentals of the theory of plate tectonics and its applications to regional geology. Physical processes and kinematics of plate motions, geology and geophysics of modern and ancient plate boundaries, and plate tectonic evolution of major orogenic belts examined.

Prerequisite: GLG 322, 357, or permission of instructor.

GLG 496/GLG 596. Isotopes in Environmental Processes. (3)

Focuses on applications of isotopes to environmental processes. Topics include introduction to environmental isotopes and basics of isotope fractionation, isotopes used as tracers in the hydrological cycle to identify and quantify reaction pathways for both clean and contaminated landscapes, dating of modern and paleo-groundwaters. The emphasis is given to the role of isotopes to trace sources, reactions and pathways of various contaminants in the environment.

Prerequisites: GLG 211 or permission of instructor.

GLG 497. Trends and Topics in the Geosciences. (3)

A common capstone experience where students apply their diverse backgrounds to assessing, evaluating, and interpreting cutting edge geoscience data and research in three theme areas: Earth, environment, and society; Earth's climate and life through time; Earth's physical and chemical systems. Students will further develop skills in written and oral communication, with particular emphasis on writing in multiple geoscience genres. SC.

Prerequisites: GLG 204 or 211; GLG 301 or 357 or 408.

GLG 498. Senior Thesis In Geology. (3-6)**GLG 630. Mineral Surface Geochemistry. (3)**

A study of the structure, composition, and reactivity of crystalline surfaces in aqueous environments.

Prerequisites: GLG 201, CHM 141 and permission of instructor.

GLG 640. Internship. (0-12; maximum 6)**GLG 647. Geology Graduate Student Onboarding. (1)**

Courses designed for new graduate students can build student self-efficacy, and promote equity and inclusion by helping all students develop the skills needed to succeed in graduate school. The curriculum in graduate school can be thought of as an iceberg. Much of graduate education is focused on tangible and formal skill development surrounding research and teaching. However, that is just the tip of the iceberg. This course focuses on the informal "hidden curriculum" in graduate school that can complement formal student learning to help individuals lead successful graduate careers.

Prerequisite: admission to a graduate program in the Department of Geology and Environmental Earth Science.

GLG 662. Subduction Zones. (3)

Multidisciplinary examination of the subduction zone system focusing on current research of physical processes.

Prerequisite: GLG 461/GLG 561 or permission of instructor.

GLG 670. Geochemical Modeling. (1-3; maximum 6)

Development and application of geochemical modeling tools to aid in interpretation of petrologic, major element, trace element, and isotopic data in geologic and environmental materials, for applications in a wide range of geoscience disciplines including areas such as igneous petrology, mineralogy, aqueous geochemistry, climate change and environmental forensics. Students will explore the fundamentals behind existing modeling programs and develop new modeling programs geared to specific student research interests.

Prerequisite: permission of instructor.

GLG 677. Independent Studies. (0-6)

GLG 700. Research for Master's Thesis. (1-12; maximum 12)

GLG 710. Geology Seminar. (1-3)

Open to students who have completed a year of graduate study.

GLG 720. Advanced Mineralogy. (1-3; maximum 3)

Single crystal X-ray crystallographic studies; study of crystal structure and comparative crystal chemistry of various mineral groups.

Prerequisite: GLG 643, or equivalent work in another graduate program.

GLG 730. Advanced Igneous Petrology. (1-3; maximum 3)

Experimental igneous petrology, and complex magma systems.

Prerequisite: Permission of instructor.

GLG 760. Advanced Carbonate Sedimentology. (1-3; maximum 12)

Selected topics of sedimentology and geochemistry of carbonate sediments and rocks.

Prerequisite: permission of instructor.

GLG 770. Advanced Topics in Isotope Geochemistry. (1-3; maximum 12)

Current topics in isotope geochemistry. Recent analytical advances and results of current research.

Prerequisite: GLG 527.

GLG 790. Research in Geology. (1-4; maximum 12)

GLG 850. Research for Doctoral Dissertation. (1-16; maximum 60)